

Chapter 7. Analysis of Proposed Management Alternatives

An analysis of the impacts of the proposed management project as well as the alternatives need to be evaluated in terms of the market squid resource, socioeconomics and the environment. Environmental impacts include analysis of management on species other than squid and the habitat.

7.1 Proposed Project and Rationale

7.1.1 Seasonal Statewide Catch Limitation

Option A.2 (Proposed action – status quo): Establish a seasonal catch limitation of 125,000 short tons. This seasonal catch limitation is based on the three-year recent average catch (Table 6-2) and the assumption that the stock is above B_{MSY} . This approach uses a multiplier of 1.0. Under Option A.2, a maximum seasonal catch limitation of 124,087 would be implemented (approximately 125,000 short tons as currently implemented in interim regulations).

The MSFMP selected a seasonal harvest guideline for the directed fishery of 125,000 short tons (an amount almost equal to the highest seasonal catch on record) to curtail growth of the fishery should market demand allow for such expansion. Although there is little information to indicate whether the fishery is or is not sustainable at the high catch levels experienced since the mid-1990's, as a precautionary measure, it is prudent not to allow landings to expand beyond present levels without better methods to assess the status of the resource. Given the number of currently permitted squid vessels and significant excess capacity in the fleet, dramatic increases in catch could occur in a short time frame unless a safeguard is in place. Catch trends indicate that the market squid resource appears to be quite robust and a catch limitation based on the highest recorded seasonal catch level might be appropriate for the squid fishery. Any seasonal catch limitation should be reviewed periodically by the Commission.

7.1.2 Daily Trip Limits for Market Squid Vessels and Brail Vessels

Option B.1 (Proposed action): Establish a daily trip limit between 60-90 tons daily for market squid vessels and 15 tons for brail vessels.

The proposed project establishes a trip limit between 60-90 short tons on landings for market squid vessels in order to protect the resource through distribution of harvest throughout the season, which may be of extreme

importance since the fishery targets spawning squid. The range recommended (60-90 short tons) is consistent with the current landing pattern (see Fig. 6-1) and should not significantly impact the current fleet, as most boats are operating below market-imposed trip limits under this volume. Additionally, the Department recommends establishing a 15-ton trip limit for vessels issued a brail permit, preventing brail vessels from improving their harvesting capability using improved technology or other means. A 15-ton trip limit is consistent with historical landings trends for currently permitted brail vessels (see Fig. 6-2).

7.1.3 Weekend Closures

Option C.1 (Proposed action – status quo): Continue closures from noon Friday to noon Sunday from the U.S. Mexico border to the California Oregon border.

The proposed project continues the existing weekend closures. In the absence of conclusive biological information upon which to base a quota or other management approach, a two-day per week closure allows for uninterrupted spawning in areas where squid are present. Unlike a seasonal quota or closure, this measure spreads the escapement throughout the year, rather than concentrating it during one particular period. Prohibiting fishing activity on weekends may also help alleviate conflict with other interest groups operating in the same areas.

7.1.4 Research and Monitoring Program

Option D.1 (Proposed action – status quo): Monitor the fishery through the egg escapement model while pursuing a biomass estimate of market squid.

The project institutes monitoring the squid fishery through the egg escapement model as a proxy for MSY. Until a defensible estimate of market squid biomass is available, the egg escapement model serves to protect the resource and assure sustainability of the fishery. The egg escapement method (EE) can be used to evaluate the effects of fishing mortality on the spawning potential of the squid stock. The egg escapement method can be used to assess whether the fleet is fishing above or below a predetermined sustainable level of exploitation and, thus, can be used as an effective management tool.

Option D.2 (Proposed action – status quo): Continue existing squid research and monitoring programs, especially programs aimed at the development of management models.

The proposed project continues the existing squid research and monitoring program, including fishery-dependent sampling efforts, ongoing monitoring of catch information, and continuation of independent research, especially those focused on developing management models. Further, the fishery-dependent

sampling is critical for real-time monitoring of the market squid fishery through the egg escapement model.

Option D.3 (Proposed action – status quo): Maintain logbooks for squid fishing vessels and squid light boats.

The proposed project maintains the logbook system in place by the Department for squid fishing vessels and squid light boats. These records provide valuable catch information other than landing data and may be essential in modeling the market squid population.

7.1.5 Harvest Replenishment Areas

Option E.1: Do not set aside specific areas as harvest replenishment areas for market squid.

The proposed project recommends continued evaluation and consideration of appropriate squid harvest replenishment areas. At this time, given other MPA processes in progress at the state and federal level, the proposed project does not recommend any specific closure areas for squid replenishment.

7.1.6 Live Bait Fishery and Incidental Catch of Market Squid

Option F.1 (Proposed action – status quo): Continue existing regulations that do not require a squid permit when fishing for live bait. Continue existing regulations that do not require a market squid permit for vessels landing or taking market squid not to exceed two tons in any calendar day. Modify current live bait logs to include recording market squid taken as live bait.

The proposed project continues the existing regulations that do not require a squid permit when fishing for live bait or when landing or taking market squid not to exceed two tons in any calendar day. The volume of squid taken in this manner is small; additionally, squid landed as live bait are highly valued by recreational fisheries along the West Coast, primarily in southern California.

7.1.7 Market Squid Fleet Capacity

Option G.2 (Proposed action): Establish a capacity goal for market squid vessels that produces a moderately productive and specialized fleet. This option assumes that the maximum catch that each boat made is caught on every trip. If the vessel fished the highest average number of day per season (45), 52 vessels operating in this manner would land the maximum seasonal catch. This option would then set the capacity goal for light vessels at 52 light boats.

The proposed project sets a capacity goal based on expectations of moderate productivity and specialization for squid fishing activity by the vessels in the fleet.

Only 10 vessels are needed to provide the physical capacity to catch in excess of 125,000 tons per season under the most efficient of conditions, while 104 vessels are needed to catch this amount under marginal conditions where squid may or may not be the primary focus of a vessel's fishing activity. A moderate capacity goal of 52 vessels is recommended based on the current analysis of fleet capacity. While this capacity goal is slightly lower than the number of active vessels in the fleet, it does allow for some diversification in other fisheries such as sardine, tuna, and mackerel, while significantly reducing excess fleet capacity from vessels that are insignificant participants or have never been active in the squid fishery. The proposed project sets the capacity goal at 52 vessels based on the long-term ratio of 1:1 of roundhaul vessel to light boats during fishing activities.

Catch data are not the best indicator of resource abundance nor of what the resource may or may not be able to sustain, and market forces largely influence the volume of take. However, establishing a moderate capacity goal does incorporate this information based on prior vessel activity, while allowing for some amount of variability in activity should market conditions or availability of the resource change.

A capacity goal is a target value that may be disruptive if implemented immediately. Providing initial qualifying criteria, implementing provisions for permit transferability, and encouraging additional attrition (by possibly establishing substantial permit fees) are recommended mechanisms to help reduce the number of vessels in order to achieve the capacity goal in a less disruptive manner.

Option G.4 (Proposed action): Establish a capacity goal for brail vessels at 18 vessels.

The proposed project supports a brail fleet capacity goal of 18 vessels, which is larger than the current fleet of approximately 13 vessels. Although this capacity goal is larger than the currently active fleet size, it provides adequate insurance against unlimited expansion of this component of the fishery. The brail fleet produces only a small fraction of the overall take, but it is in the best interest of the fishery to curtail growth of this sector until more information is available by preventing an open-access situation. Additionally, at any time these vessels could develop more efficient methods of operation which could change the overall catch contribution made by this component of the fishery.

7.1.8 Issuance of Initial Permits

Option H.4 (Proposed action): To qualify for a market squid vessel permit, all participants must hold a current market squid vessel permit and have made 50 landings during the window period (74 vessels qualify) OR participants must hold a current market squid vessel permit, have possessed a California commercial

fishing license for at least 20 years, and have participated in the squid fishery for at least one of those seasons, defined as having made 33 landings in one season (approximately 30 additional vessels qualify).

The proposed project establishes a limited entry program for the California market squid fishery following the established guidelines and policies of the Fish and Game Commission for restricted access commercial fisheries. Limited entry is widely supported by most members of the Department, the SRSC, the SFAC, and other squid fishing industry groups and conservation groups, with some processors and fishermen in opposition.

Furthermore, the proposed project sets initial issuance criteria based on prior catch history in the squid fishery for participants wishing to apply for market squid vessel, light, and brail permits in future years. Limited entry will not in itself immediately accomplish the goals and objectives of providing a sustainable resource and viable fishery for the participants. However, establishment of such a limited entry program will provide a starting point for any future programs which may be necessary to further reduce harvest capacity.

Option I.1 (Proposed action): The participant must have possessed a California commercial fishing license for at least 20 years and have participated in the squid fishery for at least one of those seasons, defined as having made 33 landings in one season (unknown number of qualifiers) to qualify for a market squid vessel permit.

Option J.2 (Proposed action): To qualify for a market squid brail permit, all participants must 1) hold a current market squid vessel permit AND 2) have made 10 brail landings during the time period 01 January 1990 through 12 November 1999. Landings are tied to the vessel, not the permit holder, and cannot be combined with landings from another vessel (15 vessels qualify, eight of which also qualify for market vessel permit) OR participants must hold a current market squid vessel permit, have possessed a California commercial fishing license for at least 20 years, and have participated in the squid brail fishery for at least one of those seasons, defined as having made 10 brail landings in one season (approximately 12 additional vessels qualify).

Option K.1 (Proposed action): The participant must have possessed a California commercial fishing license for at least 20 years and have participated in the squid brail fishery for at least one of those seasons, defined as having made 10 brail landings in one season to qualify for a market squid brail permit. The participant need not hold a current market squid vessel permit (unknown number of qualifiers).

Option L.5 (Proposed action): The participant must possess *either* a current market squid light boat permit or a market squid vessel permit and have

submitted one light boat log by 31 December 2000 to qualify for a squid light boat permit (54 vessels qualify).

Option L.6 (Proposed action): The participant must have possessed a California commercial fishing license for at least 20 years and have participated in the squid light boat fishery for at least one of those seasons, defined as having 33 nights of participation in one season to qualify for a squid light boat permit. The participant need not hold a current market squid vessel permit (unknown number of qualifiers).

Rationale for Options H.4 through L.6

The proposed project establishes a limited entry program for the California market squid fishery following the established guidelines and policies of the Fish and Game Commission for restricted access commercial fisheries. Limited entry is widely supported by most members of the SRSC, the SFAC, other squid fishing industry groups, and conservation groups, with some processors and fishermen in opposition.

Furthermore, the proposed project sets initial issuance criteria based on prior catch history in the squid fishery for participants wishing to apply for market squid vessel, light, and brail permits in future years. Limited entry will not in itself immediately accomplish the goals and objectives of providing a sustainable resource and viable fishery for the participants. However, establishment of such a limited entry program will provide a starting point for any future programs which may be necessary to further reduce harvest capacity.

The proposed project addresses the provisions of Section 8101 of the Fish and Game Code. Section 8101 specifies that any licensed 20-year California commercial fisherman is eligible to participate in the first year of a newly-established (by statute or regulation) limited entry program provided he or she demonstrates one season of prior participation in the fishery.

Recognizing that this provision exists, the proposed project incorporated it into the qualifying criteria for initial issuance of limited entry permits. Based on analysis of landings information, current squid permittees that have actively participated in the squid fishery have done so by making an average of 33 landings per season from 1981 to 1999. Although difficult to estimate, catch information from currently permitted vessels indicates there are approximately eight vessels that made 33 landings or more in a single season that would qualify under these criteria, provided their owners are 20-year California commercial fishermen. These vessels do not otherwise qualify under the Department's initial issuance proposal for vessel permits. It is anticipated that these eight vessels would meet those criteria as the fishing activity took place largely during the early 1980's, and they are registered vessels in the state of California. An additional 30 vessels were identified as meeting the 33 landing criteria during the 1999 or 2000 seasons, a time period subsequent to the SFAC window period

recommendation. As all of these vessels are from out-of-state and are only recent participants in the fishery, it is not anticipated that the owners of these vessels will likely be 20-year California commercial fishermen.

The proposed project recognizes that application of Section 8101 does not require the participant to have held a market vessel or permit during the three-year moratorium period in order to be eligible to participate in the first year of a limited entry program for squid. However, as they did not demonstrate intent to participate in the fishery in the future through purchase of a moratorium permit, it does not seem their permit should have vested value for the future through sale or transferability of the permit. Hence, the proposed project establishes non-transferable permits for market squid vessels and brail boats that meet the qualifying criteria previously described but do not hold current moratorium permits.

The proposed project establishes that entry for light boats should be limited accordingly with the number of roundhaul vessels, with the goals of reducing conflict on the fishing grounds and keeping the ratio of round haul vessels and light boats equal to 1:1.

Developing initial issuance criteria for light boats is particularly problematic given that participation is not documented via any formal method available to the Department, as the vessels are paid directly by the vessels to which they provide light. As there is no other method by which to measure light boat participation, it may be justified to consider the submission of proof of participation via receipts paid by purse seine vessels to the light boats for their services. There is no known precedent in Department limited entry programs to base entrance criteria upon proof of participation through documents other than official Department records and landing receipts. Since May 2000, a mandatory logbook has been in place for the squid fishery and these records document light boat participation. Current records indicate that 64 market squid light boat and market squid vessel permit holders have submitted at least one light boat logbook prior to 31 December 2000. The proposed project uses this criterion for qualifying light boats for initial issuance of permits.

Since statute provides opportunity for 20-year California fishermen to enter the fishery for the first year of a limited entry program with proof of prior participation, and since the 33 landings average has been recommended as criteria to deem participation in a season for vessel participation, it would follow that similar provisions should be established to allow participants to qualify for a permit. The proposed project supports allowing 20-year participants to submit proof of participation amounting to 33 days of activity in a season via receipts or other appropriate evidence to be determined by the Commission or as qualifying evidence. There is no estimate of how many vessel owners would qualify for a light vessel permit under this provision.

PRELIMINARY DRAFT MARKET SQUID FISHERY MANAGEMENT PLAN
DATED: MAY 15, 2002

Table 7-1. Summary of proposed project initial issuance limited entry criteria.		
Permit Type	Initial Issuance Criteria	Anticipated number of Qualifiers
Market Squid Vessel Permit	Possession of a valid 2000/01 market squid permit; 50 market squid landings between January 1, 1990 and November 12, 1999 OR a 20-year CA commercial fishermen with one season of participation in the squid fishery, defined as making 33 landings or more in that season.	74 + 10 = 84
Market Squid Vessel Permit (Non-Transferable)	Does not possess a current market squid permit; a 20-year CA commercial fishermen with one season of participation in the squid fishery, defined as making 33 landings or more in that season.	Unknown
Market Squid Brail Permit	Possession of a valid 2000/01 market squid permit; have made 10 brail landings during the time period January 1, 1990 through November 12, 1999 OR have possessed a California commercial fishing license for at least 20 years, and have participated in the squid brail fishery for at least one of those seasons, defined as having made 10 brail landings in one season.	7 + 12 = 19
Market Squid Brail Permit (Non-Transferable)	Does not possess a current market squid permit; a 20-year CA commercial fishermen with one season of participation in the squid brail fishery, defined as making 10 brail landings in one season.	Unknown
Market Squid	The participant must 1) possess <i>either</i> a current market squid permit OR a market squid vessel permit AND 2) submitted one log by December 31, 2000. OR may or may not possess a current market squid permit, but have possessed a California commercial fishing license for at least 20 years, and have participated in the squid fishery for at least one of those seasons, defined by submission of proof of participation amounting to 33 days of activity via receipts or other appropriate evidence.	64 + Unknown

7.1.9 Permit Transferability

DATED: MAY 15, 2002

Option M.3 (Proposed action): Establish full transferability of market squid vessel permits based on comparable capacity (within 5%) – this option will not assist in achieving the capacity goal, although it will prevent increase in fleet capacity while allowing for new vessels to enter the fishery.

Option M.4 (Proposed action): Establish transferability of market squid vessel permits to a vessel of larger capacity under a '2 for 1' or '3 for 1' permit retirement – this option will allow vessel owners to increase their vessel capacity by transferring their permit to a replacement boat and surrendering one or two additional permits. This may help to achieve the capacity goal if the capacity of the vessel whose permit is being retired is greater than the additional capacity of the new vessel.

- 2 for 1 - Permit holders wishing to increase their current capacity more than 5 percent and less than 35 percent must acquire another market squid vessel permit and surrender it to the Department for retirement.
- 3 for 1 - Permit holders wishing to increase their current capacity in excess of 35 percent must acquire and surrender two market squid vessel permits to the Department for retirement.

Option N.1 (Proposed action): Establish full transferability of market squid brail permits – provided a 15-ton daily trip limit for these vessels is implemented, there is no specific reason to restrict transfer of brail permits as they are a minor component of the fleet and do not significantly contribute to the fleet capacity.

Option O.2 (Proposed action): Establish full transferability of light boat permits with a '2 for 1' permit retirement – this would help to meet the fleets' needs and help to achieve the light boat capacity goal.

For market squid vessel permits, the proposed project establishes transferability of these permits to a vessel of comparable capacity, within five percent. This gives the permit holder some flexibility when another vessel is required because it is often difficult to find exact matches and provides fishermen who wish to retire the opportunity to sell their boat and/or permit to new participants. Additionally, the proposed project allows upgrades via transfer to vessels of larger capacity under specified conditions. Using a '2 for 1' or '3 for 1' permit retirement system, those in the fleet wishing to increase their personal catching capacity may do so while simultaneously generating a net loss in overall capacity of the fleet, which will aid in achieving the capacity goal.

For brail permits, the proposed project allows full transferability of these permits. Given they are a minor component of the fleet and the number of currently active brail vessels is less than the suggested capacity goal, there is little concern regarding overcapitalization at this time.

As transferability has been identified as a primary method to aid in achieving capacity goals once an initial number of permits has been determined, provisions for transferability are largely dependent on the difference between the number of initial permits and the selected capacity goal. In the case of light boats, the number of initial vessels identified under various initial issuance criteria options is highly variable. Hence, transferability options established in the proposed project are widely varied. Provided the proposed and more restrictive initial issuance criteria is adopted, which is anticipated to yield a number of vessels close to the capacity goal, the proposed project establishes transferability under a '2 for 1' retirement system until the capacity goal is reached, at which time transferability of permits will no longer be restricted. Should initial issuance criteria yield a significantly larger number of vessels, a '3 for 1' retirement system for light boats would be established.

Following implementation, should the number of brail qualifiers be below the selected capacity goal, and given that vessels which brail squid simultaneously work with roundhaul vessels as light boats, the proposed project allows a '2 for 1', '3 for 1' or '4 for 1' retirement system for light boat permits to acquire a brail permit, depending on the initial number of light boat permits issued.

7.1.10 Transferability Fee Structure

Option P.1 (*Proposed action*): Set the permit transfer fee at \$1,000.

The proposed project establishes an appropriate fee to transfer market squid vessel, brail, and light boat permits to assist with the cost of squid research and management programs, and to provide adequate monitoring and implementation of a restricted access program. The Department further recommends establishing a \$1000 fee for permits transferred to a new owner or vessel.

Option P.1 (*Proposed action*): Set the permit transfer fee at \$1,000

7.1.11 Gear Restrictions

Option Q.1: (*Proposed action and status quo*): Maintain existing gear restrictions which states that each vessel fishing for squid and lighting for squid will utilize a total of no more than 30,000 watts of light to attract squid at any time and that each vessel fishing for squid or lighting for squid will reduce the light scatter of its fishing operations by shielding the entire filament of each light used to attract squid and orient the illumination directly downward, or provide for the illumination to be completely below the surface of the water.

The current regulations are meant to reduce the total amount of light each vessel may use and keep the light from shining on land where it may impact seabirds or coastal communities. Although the effectiveness of shielding lights and setting a maximum wattage with regard to seabird productivity has not been determined,

the proposed project continues existing gear restrictions on light wattage and shielding that were implemented by regulation to address potential interactions with coastal communities. Alternatives to the standard lights that are used by the fishery need to be investigated, including, but not limited to underwater lighting. Further discussions with coastal communities need to be encouraged to avoid any future objections regarding lighting for squid.

7.1.12 Area and Time Closures to Address Seabird Issues

(No alternative to address the bird nesting issues has been decided).

Option R.1: Establish areas that are closed to squid fishing around San Miguel, Anacapa and Santa Barbara islands from February through October. The area closure should be one nautical mile from the high water mark for these islands. The closure would protect fourteen seabird species (including one endangered and six species of special concern) during their breeding seasons.

Option R.2: Establish areas that are closed to squid fishing around Anacapa and Santa Barbara islands from March through August. The area closure should be one nautical mile from the high water mark for these islands. This closure should protect brown Pelicans, as well as other seabird species, during the height of their breeding season.

Option R.3: Establish areas that are closed to squid fishing using attracting lights around San Miguel, Anacapa and Santa Barbara islands from February through October. The area closure should be one nautical mile from the high water mark for these islands. The closure should offset the potential negative impacts of light pollution at seabird rookeries.

Option R.4: Establish area and time closure areas for fishing for squid using lights around Anacapa and Santa Barbara islands from March through August. The area closure should be one nautical mile from the high water mark for these islands. This area and time closure should offset the potential negative impacts of light pollution from squid fishing and lighting vessels for protection of brown Pelicans, as well as other seabird species, during the height of their breeding season.

Option R.5 (*Status quo*): Maintain already established wattage and shielding regulations (refer to Option Q.1, Section 7.1.11).

7.1.13 Advisory Committee

Option S.1 (*Proposed action*): Establish one advisory committee for the squid fishery, which includes scientists and industry representatives.

The proposed project establishes a single squid fishery advisory committee comprising industry, science, and environmental community members of no more

than 12 individuals. The committee will serve to review and develop squid fishery management options and evaluate research needs and objectives and present their findings to the Department. In addition, the committee will recommend needed changes or additions for the MSFMP, as well as serve as a direct connection to the entire market squid industry.

7.1.14 Permit Fees

Option T.1 (Proposed action): Establish an annual permit fee of \$2500 for the squid fishery for fishing vessels, brail vessels and light boats.

The proposed project requires that an appropriate annual fee for market squid vessel, brail, and light boat permits be established to (1) cover the cost of squid research and management programs, and (2) provide adequate monitoring and implementation of a limited entry program. The proposed project sets an annual fee of \$2500 for squid fishing and lighting permits.

7.2 Impacts of the Proposed Actions

7.2.1 Squid Resource Impacts

7.2.1.1 Seasonal Landing Limit

Option A.2: A seasonal harvest guideline for the directed fishery of 125,000 short tons (an amount almost equal to the highest seasonal catch on record) would serve to curtail growth of the fishery should market demand allow for such expansion. Historic landings information indicates a lack of squid available to the fishery during El Niño periods. This option does not provide for low abundance in traditional spawning areas during El Niño periods when the resource may need additional protection. There are no data to suggest that that market squid population declines during an El Niño period. The 1997-1998 El Niño was followed by record market squid landings. This, combined with a lifespan of less than one year, intimates that the species is robust and sustainable with a harvest of 125,000 tons. Seasonal landings after the 1997-1998 El Niño were 126,772 (1999-2000) and 123,400 tons (2000-2001).

Preliminary estimates for the 2001-2002 fishing season indicate that landings were approximately 97,000 tons, a 21% decline from the previous season. Squid landings are highly variable due to market demand, export tariffs and environmental conditions, any of which might account for lower landings. Although biological data on market squid remain scarce, one hypothesis to the lower landings for the 2001-2002 season might be that two consecutive seasons (1999-2000 and 2000-2001) of record fishing pressure did not provide sustainable spawning escapement.

Because a stock biomass estimate is not available, historical landings data need to be used for setting a seasonal catch limit. However, it would be cautious to

combine a catch limit based on landings with known biological data, which is where the egg escapement model comes into play. The egg escapement method (Option D.1) to monitor the squid fishery combined with a seasonal catch limit should ensure that a sufficient number of eggs escape the fishery for sustainability of the resource.

7.2.1.2 Daily Trip Limits

Daily trip limits (Option B.1) will protect the resource through distribution of harvest throughout the season, which may be of extreme importance since the fishery targets spawning squid. Market squid have a lifespan of less than one year and age analysis has shown that a new cohort enters a minimum of seven times annually (Maxwell 2001). Daily trip limits, combined with a restricted access program (section 7.2.2) would serve to disseminate the fishery resulting in reduced fishing effort on specific spawning aggregations and locations.

The current fishery is subject to daily market orders, which are usually on the order of 30 tons. If daily trip limits are not established and market conditions changed, fishing effort could disproportionately target individual cohorts. No biological data are available to determine the effects of increased pressure on certain cohorts. Setting a trip limit should serve to protect individual cohorts.

7.2.1.3 Weekend Closures

In the absence of conclusive biological information upon which to base a quota or other management approach, a two-day per week closure (Option C.1) allows for uninterrupted spawning in areas where squid are present. The weekend closure option is designed to allow a consecutive two-day reprieve from fishing pressure to allow spawning. Option C.1 would provide protection to the resource by allowing spawning to occur and egg cases deposited without disturbance from the fishery. Unlike a seasonal quota or closure, this measure spreads the spawning escapement throughout the year, rather than concentrating it during one particular period. Prohibiting fishing activity on weekends may also help alleviate conflict with other interest groups operating in the same areas.

Eliminating weekend closures might increase fishing pressure disproportionately throughout the season, but with a seasonal landing limit in place, would not increase total seasonal fishing pressure. The weekend closure went into effect February 2000, near the end of the 1999-2000 season. The 1999-2000 season has the highest landings on record for California (126,772 tons). The following season had landings that were three percent less than the 1999-2000; this suggests that spawning squid can be allowed a consecutive two-day respite from fishing pressure without reducing the total harvest.

7.2.1.4 Research and Monitoring Programs

7.2.1.4.1 Egg Escapement Method

Option D.1 is a reproductive escapement model generally referred to as the egg escapement method. The egg escapement method is generally based on a modeling approach that addresses the squid's life history, with a focus on the mortality and spawning rates of sexually mature females. Specifically, per-recruit analysis theory is used to generate stock parameter estimates, such as mean standing stock of eggs per harvested female, eggs per recruit, and egg escapement; all of the estimates are evaluated across a range of fishing mortality (F). To gauge the fishery's impact on the squid population, the estimated reproductive output of the harvested population is compared to the population's output in the absence of fishing. In practical terms, the egg escapement approach can be used to evaluate the effects of F on the spawning potential of the stock and in particular, to examine the relation between the stock's reproductive output and candidate proxies for the fishing mortality that results in MSY (F_{MSY}). However, it is important to note that this approach does not provide estimates of historical or current total biomass and thus, a definitive yield (i.e., quota or Acceptable Biological Catch) cannot be determined at this time. Ultimately, the egg escapement approach can be used to assess whether the fleet is fishing above or below an a priori-determined sustainable level of exploitation and in this context, can be used as an effective management tool.

The egg escapement method offers advantages for squid fishery management. First, it allows for "real-time" management of the fishery, without an unnecessarily large investment in personnel or regulations. Secondly, the method clarifies the role and importance of sample data on age, reproductive anatomy, and fishing effort, which collectively, allow researchers to conduct the most thorough assessment at this time. In summary, the current port sampling program implemented by the Department, along with newly developed laboratory and analysis procedures conducted by the NMFS (Southwest Fisheries Science Center, SWFSC), can provide an objective method for establishing MSY-based management goals for the squid resource.

The Coastal Pelagic Species Management Team (CPSMT) of the PFMF recommended that the egg escapement model be based on $M = 0.15$ and $\nu = 0.45$ (both are daily rates), given: (1) data on the energetics of egg production and longevity of sexually mature adults indicate higher values of M are more likely than lower values; and (2) anatomical examinations of reproductive organs of young spawning females support egg-laying rates that are roughly equivalent to $\nu = 0.45$. A "threshold" level of egg escapement can be practically interpreted as a level of "reproductive" (egg) escapement that is believed to be at or near a minimum level that is considered necessary to allow the population to maintain its level of abundance into the future (i.e., allow for "sustainable" reproduction year after year). It is important to note that a threshold level of egg escapement applicable to this species is not known in strict terms at this time (and likely not a fixed value on an annual basis), but rather, determined from evaluating general

patterns of harvest observed in the squid fishery off California, as well as examining similar reference points relied upon in other squid fisheries as approximate guidelines. It is recommended that a threshold value of 0.3 (30%) be used initially, given: (1) a reproductive escapement threshold of roughly 0.4 (40%) has been used effectively in other squid fisheries (e.g., *Illex argentinus*, *Loligo gahi*) – keeping in mind that the Falkland Island fishery harvests primarily juveniles; (2) not all of the squid spawning grounds off the California coast are subject to fishing pressure; (3) an existing weekend closure allows two days per week for spawning in the absence of fishing; and (4) the daily mortality of females during spawning is likely quite high. Given the reasons above, it is certainly possible that a more appropriate threshold level is even lower than 0.3; however, it would be prudent to 1) monitor this new approach for some time before adopting a lower threshold; 2) investigate uncertainties about the retention of eggs in the females after capture; 3) evaluate possible fishery-dependent sources of mortality after spawning, such as fishing gear destruction of egg beds; 4) consider the role of squid, members of a lower animal trophic level of the marine ecosystem, play as a forage species utilized by animals at higher trophic levels; and 5) assess sample data which indicates that it is not likely that the recommended threshold will hamper the operations of the fishery as observed since the mid 1990s.

It is important to remember that the egg escapement method as a proxy for MSY is only a provisional resolution for MSY; either an acceptable estimate market squid biomass is needed or further refinement of the egg escapement method. There are four areas of the egg escapement method that require additional study: 1) selection of a “preferred” model scenario; (2) selection of a “threshold” level of egg escapement (egg escapement value) that can be considered a warning flag when tracking the status of the population; (3) fishery operations in (and after) ENSO events; and finally, (4) necessary management-related constraints.

7.2.1.4.2 Squid Research and Monitoring Programs

Continuing existing squid research and monitoring programs (Option D.2), especially programs aimed at the development of population models serve to protect the resource.

7.2.1.4.3 Logbooks

Logbooks (Option D.3) provide valuable catch information and may be essential in modeling the market squid population (resource).

7.2.1.5 Harvest Replenishment Areas

Establishing marine protected areas (MPAs) to ensure that the MLMA’s objectives for protection of habitat and ecosystem integrity as well as sustainable

fisheries are met is an effective management tool. Fishery management benefits of the MPAs, as well as of temporary closed areas, include buffering against management mistakes, full protection for some fraction of target and bycatch populations, and possible increased reproductive potential due to no harvest of spawning squid.

The proposed project does not suggest specific harvest replenishment areas (Option E.1 - status quo) for market squid because at this time, there are two reserve establishment processes in progress at the state level. The request for Marine Protected Areas at the northern Channel Islands preceded the Marine Life Protection Act by nearly one year. This legislation requires that the Department develop a plan for establishing networks of MPAs in California waters. These MPAs will supplement the current reserves in addition to the areas protected at the Channel Islands. In addition to the reserve structure, certain "de facto" reserves exist at sites where squid spawning occurs; these sites are not regularly utilized by fishermen. The preferred alternative for a marine protected area network in the Channel Islands National Marine Sanctuary closes approximately 26% of the island's coastal waters. Several proposed sites are traditional squid fishery grounds and these closures are predicted to reduce squid fishing areas by 13%. Further, there are several areas that are closed to the use of roundhaul nets (i.e., Carmel Bay, Santa Monica Bay, north side of east Anacapa Island, the front side of Santa Catalina Island, La Jolla Reserve) that are known squid spawning sites. Evaluation and identification of appropriate squid harvest replenishment areas as a future tool for resource protection should be combined with other processes (Channel Islands and Marine Life Protection Act).

7.2.1.6 Live Bait Fishery and Incidental Take of Market Squid

The proposed action for the live bait fishery (Option F.1) is to continue the existing regulations that do not require a squid permit when fishing for live bait or when landing or taking market squid not to exceed two tons in any calendar day. Although the volume of squid taken in this manner is not quantified, it is believed to be small in relation to the overall fishery. This action maintains the status quo and has no significant impact on the resource.

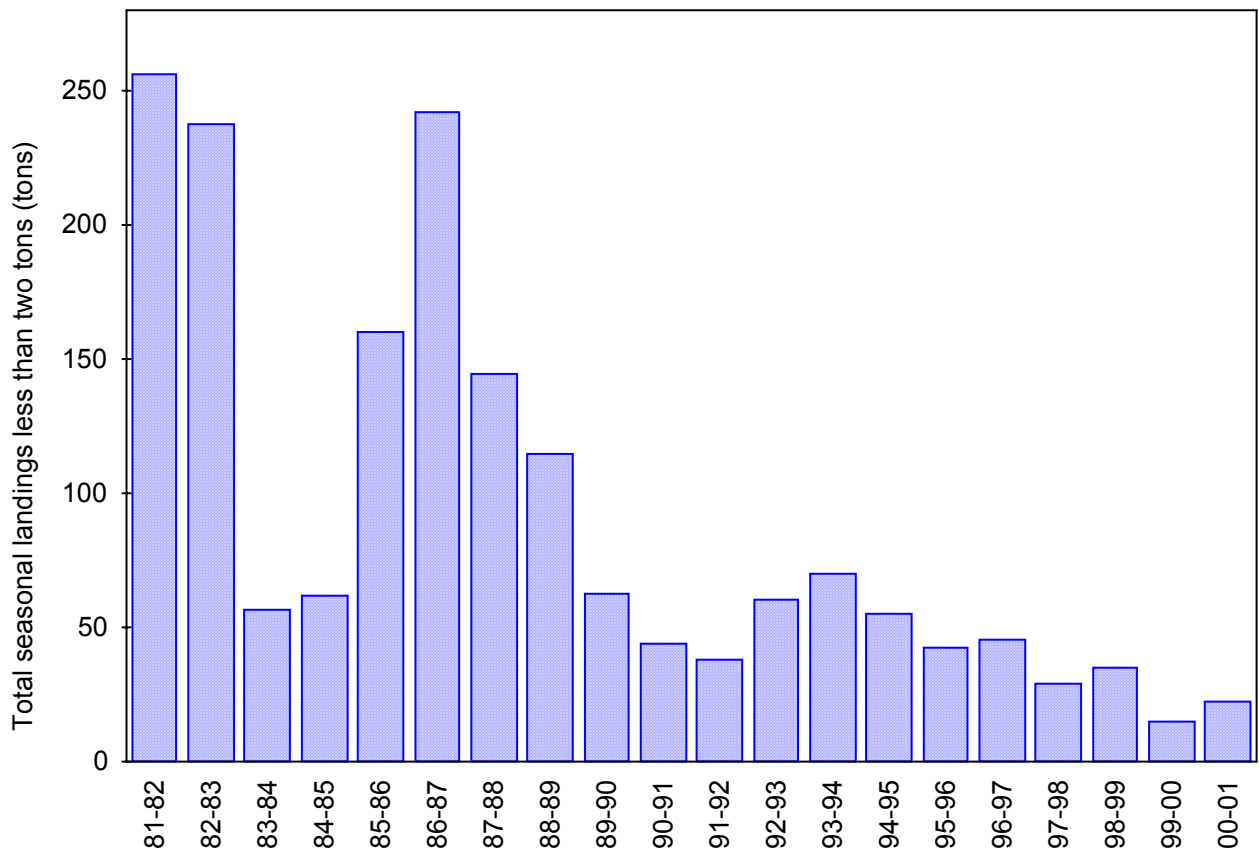


Figure 7-1. Market squid landings less than or equal to two tons by season.

Landings of market squid less than or equal to two tons has been decreasing since the 1980s (fig. 7-1). Because the actual amount of squid taken as live bait is unknown, bait logs would provide information about the impact of this industry on the resource and it is recommended that the current live bait logs be modified to include market squid.

7.2.1.7 Restricted Access Program

The limited entry options (Options G.2, G.4, H.4, I.1, J.1, K.1, L.5, M.4, N.1, O.2 and P.1) are not anticipated to have any unfavorable impact on the resource. The proposed project has a seasonal landings limit of 125,000 and a daily trip limit between 60-90 tons. Limited entry programs, combined with these management measures are designed to promote a sustainable fishery. Limited entry without these measures has socioeconomic impacts only, thus, only the impacts to the resource from the seasonal landings limit and daily trip limit are relevant and were discussed earlier (sections 7.2.1.1 and 7.2.1.2).

7.2.1.8 Gear Restrictions

Maintaining current shielding and wattage restrictions on lighting gear (Option Q.1) is the status quo. The current regulations are meant to reduce the total amount of light each vessel may use and keep the light from shining on land where it may impact seabirds or coastal communities and have no impact on the market squid resource. They are discussed under other ecological concerns (section 7.2.3).

7.2.1.9 Seabird Rookeries

Implementation of area and time closures to protect nesting seabirds (Options R.1, R.2, R.3 and R.4) has no significant impact on the market squid resource. They are evaluated under socioeconomic (section 7.2.2.9) and other ecological concerns (section 7.2.3).

7.2.1.10 Advisory Committee for Squid Fishery

An advisory committee for the squid fishery (Option S.1) comprising members of the squid industry and scientific communities will have no significant adverse impact on the market squid resource.

7.2.1.11 Annual Permit Fee

Squid research and monitoring programs are essential for the market squid. The biological knowledge of this animal is still in the data-poor stage. Annual costs for the market squid program are \$750,000 and these costs need to be offset. It is likely without adequate funding for the market squid project through an annual permit fee, no new research would be expected which would likely have a significant impact on the population, but cannot be evaluated. Currently, the market squid project is funded through the Department of Fish and Game's Preservation Fund.

7.2.2 Socioeconomic Impacts

The proposed action will not have a statewide significant economic impact on businesses, including the ability of California businesses to compete with businesses in other states. However, each market squid vessel permittee, market squid permittee, buyer and processor is considered a business and the proposed project is evaluated in terms of impacts on these groups within California and associated communities.

7.2.2.1 Seasonal Landing Limit

A maximum seasonal catch limitation of 125,000 short tons (Option A.2) is not likely to cause significant economic impacts to businesses as this value reflects the highest seasonal catch on record. However, it does limit future economic gain which could be realized with opportunities for expansion to other markets.

7.2.2.2 Daily Trip Limits

A daily trip limit between 60-90 short tons (Option B.1) is not expected to have a statewide significant economic impact on businesses. For some larger capacity vessels, a round-haul vessel possession limit of 60 short tons could hinder profit margins if they are not operating under market-imposed trip limits. Maximum estimated seasonal lost revenue could total \$420,000 (1.2% of revenue) to the fleet. From Department landing receipt records, 42 vessels have been identified as making at least one squid delivery in excess of 60 short tons during the 1998-1999 to 2000-2001 seasons. Average seasonal loss in revenue for each of these vessels would be approximately \$9,430. Landings greater than 60 tons made up more than 10% of the landings for 12 vessels; the percent of landings for vessels with more than 10 landings greater than 60 tons ranges from 3.9% to 55% of total landings for the vessels. There were 11 vessels with landings greater than 90 tons. The number of landings greater than 90 tons ranged from 1-15 for these 11 vessels and made up between 0.4% to 30.6% of the vessels total landings. A brail vessel possession limit of 15 short tons could cause a maximum estimated seasonal loss of \$140,000 in revenue to the brail fleet, but is likely to be significantly less. From Department landing receipt records, two brail or scoop vessels have been identified as making at least one squid delivery in excess of 15 short tons since 1998. Average seasonal loss in revenue for each of these vessels would be approximately \$7,375.

The no trip limit alternative would have no significant socioeconomic impacts on the squid fishery.

7.2.2.3 Weekend Closures

Weekend closures (Option C.1) are status quo for the market squid fishery. Weekend closures south of Point Conception went into effect February 2000. Although weekend closures effectively close 28.7% of fishing time and could have resulted in a loss of 28.7% of income, the closure does not appear to have impacted the amount of squid landed. The 2000-2001 fishing season landed 123,400 short tons of market squid, the third highest landings on record and within three percent of the record (126,772 for the 1999-2000 season). Landings data indicate that catch is 6% higher the day following weekend closure as compared to landings from two years prior (CDFG 2001).

The alternative to eliminate weekend closures would have no significant socioeconomic impacts on the squid fishery.

7.2.2.4 Research and Monitoring Programs

The egg escapement method (Option D.1) would most likely produce a reliable and stable MSY proxy/control rule that would allow for landings at or above their

current levels. Compared to the status quo there would not be any significant changes in net economic benefits and fishing community economic activity if the MSY proxy under this Alternative is at current landing levels. If the MSY proxy under this Alternative is greater than current landings, then a proportionate increase in consumer and producer surplus and fishing community economic activity, above those anticipated under the status quo, is expected.

The egg escapement method as a proxy for MSY has the potential to change harvest guidelines. If market squid harvest is not allowing escapement at an average rate of 30% or higher, this would indicate that not enough spawning has taken place to ensure sustainability of the fishery. It is believed that the sustainability of the fishery is critical to the economy of fishermen and changes in harvest guidelines to ensure adequate escapement would be to their advantage. The egg escapement method is real-time monitoring of the fishery and as such, it will serve as a indicator of the fishing pressure on the spawning stock of squid and will in itself, monitor the 125,000 ton seasonal landing limit.

Permit fees are structured to cover the costs of the research and monitoring programs within the squid fishery, including logbooks. Socioeconomic impacts are presented in section 7.2.2.11.

7.2.2.5 Harvest Replenishment Areas

The proposed project (Option E.1) is not to set aside specific areas as harvest replenishment areas for market squid. This alternative is the status quo and would have no significant socioeconomic impacts of the squid fishery.

Creating harvest replenishment areas where squid spawning occurs, but that are not regularly used by fishermen would not have a significant socioeconomic impact on the squid fishery at this time, but might have a future economic impact if there is a demand to fish these areas for squid.

7.2.2.6 Live Bait Fishery and Incidental Take of Market Squid

Maintaining the continuing regulations that do not require a squid permit when fishing for live bait or when landing or taking market squid not to exceed two tons in any calendar day should have no significant socioeconomic impacts on the commercial squid fishery because it is believed that the quantity taken is minor.

No economic data are available for the live bait fishery to evaluate the impact of the alternative action.

7.2.2.7 Restricted Access

A restricted access program (Options G.2, G.4, H.4, I.1, J.1, K.1, L.5, M.4, N.1, O.2 and P.1) for the proposed project has been designed to provide for an

orderly fishery, promote conservation among fishery participants and maintain the long-term economic viability of the fishery.

7.2.2.7.1 Capacity Goal

The capacity goal of 52 fishing vessels, 18 brail vessels and 52 light boats should have no significant socio-economic impacts on the squid fishery because of the method (2 for 1 permit transfers) that is set to attain that level.

7.2.2.7.2 Initial Issuance

In the 2000-2001 fishing season, 195 market squid vessel permits were issued. Many market squid vessel permits were issued to light boats as there were no criteria for issuance between the market vessel and light boat as far as vessels that light for squid. The objective of an initial issuance of permits to 74 vessels, based on landings, is to eliminate those vessels which have minimally participated in the fishery. During the moratorium, there were 165 vessels that landed squid. Under the proposed management, only 74 vessels would remain. Table 7-2 shows the dollars paid ex-vessel to the 74 vessels that qualify and those that do not qualify. Recently, these vessels accounted for approximately 10-13% of ex-vessel revenue and increased to more than 24% in the 2000-2001 season.

Table 7-2. Dollars paid ex-vessel for landings greater than two tons divided between vessels that qualify under the proposed project and those that do not qualify. Dollars are adjusted for inflation to the 2000 dollar value (source: US Bureau of Labor Statistics).				
Season	Qualifying	Non-qualifiers	Total	% Non-qualifiers
1981-1982	\$3,627,359	\$4,926,747	\$8,554,107	57.6
1982-1983	\$2,078,252	\$2,771,068	\$4,849,320	56.3
1983-1984	\$234,327	\$229,767	\$464,093	43.8
1984-1985	\$217,341	\$709,044	\$926,385	77.0
1985-1986	\$2,552,177	\$3,310,321	\$5,862,498	55.7
1986-1987	\$4,349,710	\$2,168,381	\$6,518,090	32.5
1987-1988	\$3,445,338	\$1,350,583	\$4,795,921	28.0
1988-1989	\$4,817,556	\$2,222,581	\$7,040,137	31.4
1989-1990	\$2,776,025	\$1,305,436	\$4,081,461	32.0
1990-1991	\$4,386,542	\$718,349	\$5,104,891	14.1
1991-1992	\$3,559,648	\$465,778	\$4,025,425	11.5
1992-1993	\$2,399,716	\$411,283	\$2,811,000	14.4
1993-1994	\$7,805,277	\$942,405	\$8,747,682	10.6
1994-1995	\$15,142,837	\$1,775,605	\$16,918,443	10.6
1995-1996	\$20,362,602	\$1,638,421	\$22,001,023	7.4
1996-1997	\$22,819,224	\$2,880,067	\$25,699,291	11.1
1997-1998	\$2,724,801	\$117,825	\$2,842,626	3.8
1998-1999	\$4,639,488	\$746,156	\$5,385,644	13.3
1999-2000	\$32,107,706	\$4,905,511	\$37,013,217	13.3
2000-2001	\$18,482,112	\$5,926,552	\$24,408,664	24.3

Because the proposed project has a landings limit, it is believed that the revenue paid to the vessels that do not qualify for initial issuance will be distributed among

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other vessels. However, the distribution may not be equally divided among the ports. The maximum economic impact to the three main port areas is shown in Table 7-3. Only data from the moratorium period were used for analysis. Since part of the 1998-1999 season landings were decreased due to an El Niño, a second analysis was done using a two-season average.

Table 7-3. Potential economic affects to counties from initial issuance criteria. Landings data do not include landings two tons or less as a permit was not required. Dollars are adjusted for inflation to the 2000 dollar value (source: US Bureau of Labor Statistics).					
Season	Los Angeles	Monterey	Santa Barbara/Ventura counties	Other	Total
1998-1999	\$82,878	\$0	\$642,074	\$1,044	\$725,996
1999-2000	\$910,174	\$0	\$3,978,108	\$7,153	\$4,895,435
2000-2001	\$2,192,519	\$105,440	\$3,599,841	\$12,315	\$5,910,114
3-year average	\$1,061,857	\$35,147	\$2,740,007	\$6,837	\$3,843,848
Projected reduction revenue output	\$1,911,343	\$48,502	\$4,247,012	N/A	\$6,206,856
Projected job loss	11	<1	27	N/A	<39
2-year average	\$1,551,347	\$52,720	\$3,788,974	\$9,734	\$5,402,775
Projected reduction revenue output	\$2,792,424	\$72,753	\$5,872,910		\$8,738,087
Projected job loss	15	<1	37	N/A	<53
Economic Multipliers Used*					
Income	1.80	1.38	1.55	N/A	
Employment	9.9	8.4	9.7	N/A	

* Economic multiplier source: U.S. Dept of Commerce, Bureau of Economic Analysis, RIMS II (Regional Input-Output Modeling System).

Specifically, the squid fleet is diverse in that many vessels also participate in other fisheries such as sardine, mackerel, herring or salmon which may impact the number of days fished for squid in a season. Additionally, fishery activity reflects extreme variability in squid availability during El Niño and La Niña periods, causing volume as well as seasonality of the fishery to fluctuate radically.

7.2.2.7.3 Permit Transferability and Transferability Fee

Transferability of permits confers a value on the permit itself and provides the participants a greater stake in the resource, a sense of ownership and confidence that a long-term opportunity exists in the fishery. Transferable permits with a fee of \$1000 to transfer should have no significant impact on market squid fishery socioeconomics.

7.2.2.7.4 No Restrictive Access Program

The option to continue with the existing moratorium guidelines established 01 April 1998, would allow for a reduction in fleet size only through attrition, which has been approximately 10 percent per year for squid vessel permits (see Table 3-7). This option is supported by some squid processors and fishermen, as attrition would eventually lead to achievement of the capacity goal. Attrition does not minimize disruption to current participants, nor does it provide provisions to improve the safety of existing operations by replacing older vessels. Eliminating those vessels, which have minimally participated in the fishery, is preferable and less disruptive than losing vessels with significant long-term involvement when these vessels become unsafe or the permit holder dies and the permit is lost. A combination of approaches, including appropriate initial issuance criteria, specific provisions for transferability, and prohibitive permit fees which encourage attrition, is currently the best solution for reducing fleet capacity to ensure minimal long-term socioeconomic impacts to the fishery.

The option for no limited entry/open access would allow all vessels regardless of past history to participate in the fishery provided they hold all applicable commercial fishing permits for the State of California. This option is supported by a fraction of squid processors and fishermen, but is not supported by the majority of fishermen, processors, environmental groups, or the Department because it does not provide any mechanism to prevent expansion of the fishery and would allow entrance to vessels displaced by other West Coast fisheries undergoing implementation of similar restricted access programs. While allowing for a maximum production under 'boom' scenarios of squid availability and robust market conditions, this option does not help to ensure long-term sustainability of the fishery or resource. This alternative has no significant socioeconomic impact.

7.2.2.8 Gear Restrictions

Because the proposed project is status quo, there are no significant socioeconomic impacts from the shielding and wattage restrictions on the squid fishery. The alternative of eliminating shielding and wattage restrictions would also have no significant socioeconomic impacts on the fishery.

7.2.2.9 Seabird Rookeries

Since the fishery targets spawning squid in shallow waters, a closure of one mile around Anacapa, Santa Barbara and San Miguel islands would essentially close these areas to the squid fishery during the seabird breeding season. Option R.1 would close the squid fishery for the longest period: February through October for all three islands. Option R.2 has the potential to impact the fishery as much as \$1.5 million ex-vessel (1999-2000 season) based on prior season harvests. Over \$36 million was paid ex-vessel in the 1999-2000 season (see Table 3-10); a loss of \$1.5 million would be approximately 4.2% of the total ex-vessel revenue for that season. Landings at San Miguel Island are minimal for this period so including/excluding the island would have a minimal impact on the socioeconomics of the fishery. During the last seven seasons, the squid fishery has fished for six seasons at the islands and an average of 3.0% of their landings comes from these areas.

However, it is unlikely that revenue lost will come close to these values because area closures during the breeding season would not preclude the fishermen from fishing elsewhere for market squid. On average, from February through October, the squid fishery south of Point Conception targets between 4 to 5 fishing blocks (10 x 10 nm each, Appendix D) per night. Approximately 25% of fishing nights are restricted to only one fishing block which might indicate that a value closer to 1% of fishery landings might be impacted by these closures.

Table 7-4 Dollars paid ex-vessel from February through October seasonally for fishing in areas under consideration for closure to protect nesting seabirds.								
Season	Anacapa Island (AI)	Santa Barbara (SBI)	San Miguel (SMI)	Total for AI, SBI, SMI	Percent total for AI SBI, SMI	Total for AI and SBI	Percent total for AI and SBI	Total paid ex-vessel
94-95	\$ 6,240	433,779	0	440,019	3.0	440,019	3.0	14,668,386
95-96	672,801	9,437	17,064	699,302	3.6	682,238	3.5	19,645,729
96-97	424,736	465,316	14,759	904,811	3.8	890,051	3.7	23,757,850
97-98	0	0	0	0	0.0	0	0.0	2,649,001
98-99	87,626	8,894	0	96,520	1.9	96,520	1.9	5,176,294
99-00	749,399	725,406	24,582	1,499,387	4.2	1,474,804	4.1	36,023,155
00-01	94,908	83,227	3,040	181,175	0.7	178,135	0.7	24,531,987

Note: dollars are not adjusted for inflation.

The shorter time proposed for closure is 01 March through 31 August. Again, the economic impact could be as much as \$872,373 paid ex-vessel (1999-2000 season) based on prior landings or 2.4% of earnings (Table 7-5). Landings at San Miguel Island are minimal for this period so including/excluding the island would have a negligible impact on the socioeconomics of the fishery (approximately 0.1%).

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Table 7-5. Dollars paid ex-vessel from March through August seasonally for fishing in areas under consideration for closure to protect nesting seabirds.								
Season	Anacapa Island (AI)	Santa Barbara (SBI)	San Miguel (SMI)	Total for AI, SBI, SMI	Percent total for AI SBI, SMI	Total for AI and SBI	Percent total for AI and SBI	Total paid ex-vessel
94-195	0	137,863	0	137,863	0.9	137,863	0.9	14,668,386
95-96	101,048	0	3,840	104,888	0.5	101,048	0.5	19,645,729
96-97	226,995	0	2,384	229,379	1.0	226,995	1.0	23,757,850
97-98	0	0	0	0	0.0	0	0.0	2,649,001
98-99	86,899	8,894	0	95,792	1.9	95,792	1.9	5,176,294
99-00	126,253	721,538	24,582	872,373	2.4	847,790	2.4	36,023,155
00-01	57,789	78,017	3,040	138,846	0.6	135,806	0.6	24,531,987

Note: dollars are not adjusted for inflation.

The socioeconomic impacts of area closures for market squid fishing using attracting lights would probably vary between no impact to the maximum estimate of area closures for squid fishing. However, it is unlikely that squid fishing vessels would travel to these islands to fish for squid without prior knowledge of squid aggregated in the area from light boats (O. Amoroso, pers. comm.), so it is reasonable to assume the impact would be the maximum estimated above.

Because the average impact for the last three season, (excluding seasons impacted by El Nino periods) is 3.1% and that prohibiting fishing at these certain areas during the seabird breeding season does not preclude the fishery from fishing elsewhere, and assuming that the fishery would redirect their efforts when the areas are closed to fishing, Options R.1, R.2, R.3 and R.4 would have no significant economic impact on the fishery.

7.2.2.10 Advisory Committee for Squid

An advisory committee for the market squid consisting of industry and scientific community members would serve to enhance the socioeconomics of the fishery while considering protection of the resources.

The no committee alternative should not impact the socioeconomics of the squid fishery.

7.2.2.11 Annual Permit Fee

An annual permit fee of \$2,500 is a tax-deductible business expense that will impact each vessel-owner \$2,500 annually. This permit will entitle the owner-vessel to participate in the limited entry fishery. As long as a limited entry program with transferability is adopted as part of the management of the squid fishery, a vested property value will be conferred on squid vessel and light boat permits above the \$2,500. This value will be determined by market conditions. Because of the value added to the permit in a limited entry program with transferability, there is no significant economic impact to the squid fishery.

No permit fee will result in less monitoring of the fishery and research on market squid that may impact the fishery, but cannot be evaluated.

7.2.3 Other Ecological Concerns

7.2.3.1 Trophic Interactions

7.2.3.1.1 Finfish

Market squid are commonly found schooling with coastal pelagic finfish (sardine, mackerel, and anchovy). Landings comprised of squid and one additional coastal pelagic finfish are accepted by processors. More information is available in the section (7.2.3.1.5) detailing incidental take.

Along with anchovy and sardine, market squid are important as forage to a long list of fish (Table 7-6) and they serve as an important food source for many larger pelagic fish that are commercially and recreationally important, such as white seabass, California yellowtail, kelp bass, barred sand bass, California barracuda, California halibut, and other nearshore species. Further, squid are forage for all depleted, threatened, and endangered salmon stocks along the coast. Although it is not currently possible to estimate the total amount of CPS used as forage by finfish in the California Current ecosystem or the size of CPS populations necessary to sustain predator populations, the CPS FMP, along with the MSFMP, contain the goal of providing adequate forage for dependent species. This goal is implemented through harvest policies that reserve a portion of the biomass as forage for all dependent species.

The NMFS and the United States Fish and Wildlife Service (USFWS) administer the Federal Endangered Species Act (FESA). FESA is designed to protect certain species and their habitats when other efforts have been unsuccessful. NMFS is accountable for those species that spend the majority of their lives in marine waters. This includes most marine mammal species, most marine fish, and anadromous fish such as Pacific salmon. The USFWS is charged with the implementation of programs and regulations for freshwater and terrestrial species.

Table 7-6. Finfish predators of market squid, northern anchovy, Pacific sardine, and other small pelagic fish.

Scientific Name	Common Name	Status*
<i>Engraulis mordax</i>	Northern anchovy	
<i>Sardinops sagax caeruleus</i>	Pacific sardine	
<i>Merluccius productus</i>	Pacific whiting (hake)	
<i>Alopias vulpinus</i>	Common thresher shark	
<i>Isurus oxyrinchus</i>	Bonito shark (shortfin mako)	
<i>Galeorhinus zyopterus</i>	Soupfin shark	
<i>Prionace glauca</i>	Blue shark	

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Table 7-6. Finfish predators of market squid, northern anchovy, Pacific sardine, and other small pelagic fish.

Scientific Name	Common Name	Status*
<i>Torpedo californica</i>	Pacific electric ray	
<i>Oncorhynchus kisutch</i>	Silver (coho) salmon – So. Oregon/No. California ESU**	FT
<i>Oncorhynchus kisutch</i>	Silver (coho) salmon – Central California ESU**	SE, FT
<i>Oncorhynchus tshawytscha</i>	Winter-run King (chinook) salmon	SE, FE
<i>Oncorhynchus tshawytscha</i>	Spring-run King (chinook) salmon	ST, FT
<i>Oncorhynchus tshawytscha</i>	King (chinook) salmon California coastal ESU**	FT
<i>Oncorhynchus mykiss</i>	Steelhead (rainbow trout) – Northern California ESU**	FT
<i>Oncorhynchus mykiss</i>	Steelhead (rainbow trout) – Central California ESU**	FT
<i>Oncorhynchus mykiss</i>	Steelhead (rainbow trout) – South/Central California ESU**	FT
<i>Oncorhynchus mykiss</i>	Steelhead (rainbow trout) – Southern California ESU**	FE
<i>Sebastes spp.</i>	Rockfish (many species)	
<i>Morone saxatilis</i>	Striped bass	
<i>Paralabrax nebulifer</i>	Barred sand bass	
<i>Paralabrax clathratus</i>	Kelp bass	
<i>Paralabrax maculatofasciatus</i>	Spotted sand bass	
<i>Caulolatilus princeps</i>	Ocean whitefish	
<i>Trachurus symmetricus</i>	Jack mackerel	
<i>Seriola lalandi</i>	Yellowtail	
<i>Atractoscion nobilis</i>	White seabass	
<i>Seriphus politus</i>	Queenfish	
<i>Menticirrhus undulatus</i>	California corbina	
<i>Genyonemus lineatus</i>	White croaker	
<i>Embiotocidae</i>	Perch (many species)	
<i>Sphyrna argentea</i>	California barracuda	
<i>Scomber japonicus</i>	Pacific (chub) mackerel	
<i>Sarda chiliensis</i>	Pacific bonito	
<i>Thunnus alalunga</i>	Albacore	
<i>Thunnus thynnus</i>	Bluefin tuna	
<i>Xiphias gladius</i>	Swordfish	
<i>Tetrapturus audax</i>	Striped marlin	
<i>Ophiodon elongatus</i>	Lingcod	
<i>Scorpaena guttata</i>	California scorpionfish	
<i>Squalus acanthias</i>	Spiny dogfish	
<i>Stereolepis gigas</i>	Giant seabass	
<i>Hippoglossus stenolepis</i>	Pacific halibut	
<i>Paralichthys californicus</i>	California halibut	

*SE – State-listed Endangered

FE – Federally-listed Endangered

ST – State-listed Threatened

FT – Federally-listed Threatened

**ESU – Evolutionarily Significant Unit; a distinctive group of Pacific salmon or steelhead.

Relative to CPS finfish, the market squid is a poorly understood species; the population dynamics are largely unknown. Further, no statistically defendable biomass estimate has ever been made. Current research indicates that the adult population is composed of new cohorts several times a year and that their lifespan is approximately six months (Butler et al. 2001).

7.2.3.1.1.1 Salmonids

Three salmonid species that inhabit California waters are state- or federally-listed: coho, chinook, and steelhead. An endangered species is defined under FESA as "any species which is in danger of extinction throughout all or a significant portion of its range." A threatened species is one that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." All three salmon species are listed as endangered and threatened species depending on the population or ESU.

Salmon are anadromous fish, returning to their natal rivers to spawn. Spawning is terminal for coho and chinook salmon; steelhead may survive to spawn more than once. Coho salmon spend an average of two years at sea, chinook two to three, and steelhead one to three. The ocean distribution of coho salmon in California ranges from the Oregon border to Monterey Bay; infrequent accounts of coho in Baja California have been reported. Chinook salmon are typically found as far south as Ventura River, and are occasionally sighted in San Diego. Steelhead range throughout the entire California coast. (USGS 2000)

Although small salmon are occasionally caught by squid boats, there are no known deleterious interactions between the market squid fishery and salmon. Salmon are visual predators and are actively hunting during the day; the squid fishery is active at night, decreasing the likelihood of any fishery interactions. (Erickson pers. comm.)

7.2.3.1.1.2 Analysis of Impacts

During the last ten years, market squid harvested from the CINMS ranged from a low of 529 tons (1997-1998, includes El Niño period) to a high of 88,366 tons (1999-2000, La Niña period). A statewide landings limit does not restrict fishing effort at specific fishing grounds. Although the harvest limit may be sustainable for a fishery, no information is known about its effects on the amount of forage removed from a concentrated site, which may not be evident immediately. Area closures for nesting seabirds combined with continuing a catch limit of 125,000 tons may have a potentially significant impact on finfish because displaced effort transferred to already fully developed fishing grounds may remove a significant proportion of squid as forage at certain sites. Areas closed to squid fishing to protect nesting seabirds may also serve as forage reserves.

7.2.3.1.1.3 Other Management Options

There are other management options including, fee structure, monitoring program, vessel identification, regulation of bycatch, prohibited species, size limits, and coordination with the Federal CPS Plan, under consideration in the MSFMP. Implementation of these options does not directly affect or influence squid fishery interactions with finfish, thus, they are not addressed.

7.2.3.1.2 Invertebrate Species

Market squid have not been identified as a major prey item for invertebrates although recently, the spiny brittle star (*Ophiothrix spiculata*) has been observed feeding on on market squid (Lazar pers. comm.). Market squid are a major prey item of market squid (cannibalism) and other squid taxa, but during the pelagic rather than spawning life stage.

Weekend closures, in addition to providing uninterrupted spawning for squid, should allow for uninterrupted foraging opportunities for other invertebrates. The ecological reserve areas closed to fishing (north side of East Anacapa Island to protect nesting pelicans, front side of Catalina Island, Santa Monica Bay, Carmel Bay) may also serve as potential forage reserves. Based on this limited information, there should be no impacts implementing the squid fishery management plan as compared with the status quo.

Table 7-7. Invertebrate predators of market squid, northern anchovy, Pacific sardine, and other small pelagic fish.	
<i>Loligo opalescens</i>	Market squid
<i>Decapoda (oegopsida)</i>	Ocean squids
<i>Ophiothrix spiculata</i>	Spiny brittle star
<i>Asterina miniata</i>	Bat star

7.2.3.1.3 Seabirds

7.2.3.1.3.1 Endangered Species Act (ESA), Migratory Bird Treaty Act, and Other Status Considerations

The federal Endangered Species Act (ESA) of 1973 (16 United States Code § 1531 et seq.), as amended, provides for the conservation of threatened and endangered species of fish, wildlife, and plants (Table 7-8). For bird species, the program is administered by the United States Fish and Wildlife Service (USFWS). The designation of ESA species is based on the biological health of that species. Under ESA, an endangered species is defined in the law as "any species which is in danger of extinction throughout all or a significant portion of its range." A threatened species is "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." A candidate species is "any species being considered by

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the Secretary (of Interior) for listing as an endangered or threatened species, but not yet the subject of a proposed rule." When a species is listed, the critical habitat of that species also must be designated. Critical habitats are those specific areas that are essential to the conservation of a listed species.

In addition to the ESA, all seabirds are protected under the Migratory Bird Treaty Act of 1918, which establishes a federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess...any migratory bird or any part, nest, or egg of any such bird " (16 United States Code §7030). The California Endangered Species Act (CESA) also provides for the conservation of threatened and endangered species (FGC §2062, 2067, 2068). Furthermore, the Legislature has declared it to be state policy to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat. The Department also designates taxa not listed under the federal or state endangered species acts as 'Species of Special Concern' (SSC) for species with declining population levels, limited ranges, and/or continuing threats which make them vulnerable to extinction (CDFG California Natural Diversity Database). The goal of designating a species as an SSC is to halt or reverse the species decline by calling attention to their plight and addressing the issues of concern early enough to secure long-term viability. Additionally, FGC §3511 designates two marine seabirds as "fully protected" (Table 7-8), meaning there is no issuance of permits under FGC §2081 to take such species.

Table 7-8. Acronyms and definitions for species needing special conservation status under the Endangered Species Act, California Endangered Species Act, and Marine Mammal Protection Act	
Acronym	Definition
FE	Federally listed as endangered under ESA
FT	Federally listed as threatened under ESA
FPL	Petitioned for federal listing under ESA
SE	State listed as endangered under CESA
ST	State listed as threatened under CESA
FSC	Federal species of concern
SSC	State species of special concern
FPO	Fully protected under FGC §3511
RE	Subject of Department restoration efforts
FPD	Federally proposed for delisting
DEP	Depleted under MMPA
SS	Listed as a strategic stock

Table 7-8. Acronyms and definitions for species needing special conservation status under the Endangered Species Act, California Endangered Species Act, and Marine Mammal Protection Act	
Acronym	Definition
PRO	Fully protected mammal under FGC §4700
N/D	Insufficient data to calculate PBR
N/G	Incidental take not governed under MMPA, ESA takes precedence in management of this species

7.2.3.1.3.2 Affected Environment

The coast of California supports a rich assemblage of seabirds. Seabirds spend a majority of their life at sea and are an integral part of the coastal marine ecosystem. In California waters, seabirds include members of the order Procellariiformes (e.g., storm-petrels, shearwaters, and albatrosses), Pelecaniformes (e.g., pelicans and cormorants), Charadriiformes (e.g., gulls, terns, and alcids), Gaviiformes (loons), Podicipediformes (grebes), and Anseriformes (e.g., scoters). Table 7-9 lists seabird species likely to be in California state waters and their current listing and/or designation status. The bald eagle is included because it is a listed species found seasonally along the coast and offshore islands, and the osprey is a SSC found along the coast. Those species that are federally or state listed, or those considered SSCs, are discussed in detail. Non-listed species are discussed in detail if they are documented to be involved in fishery interactions and/or consume squid as part of their diet. Additionally, common murrelets are the subject of California Department of Fish and Game restoration efforts.

Table 7-9. The federal and state status of seabirds in California state waters.*	
Species	Status**
Red-throated Loon (<i>Gavia stellata</i>)	
Pacific Loon (<i>G. pacifica</i>)	
Arctic Loon (<i>G. arctica</i>)	
Common Loon (<i>G. immer</i>)	SSC
Horned Grebe (<i>Podiceps auritus</i>)	
Red-necked Grebe (<i>P. grisegena</i>)	
Eared Grebe (<i>P. nigricollis</i>)	
Western Grebe (<i>Aechmophorus occidentalis</i>)	
Clark's Grebe (<i>A. clarkii</i>)	
Black-footed Albatross (<i>Phoebastria nigripes</i>)	
Northern Fulmar (<i>Fulmarus glacialis</i>)	
Pink-footed Shearwater (<i>Puffinus creatopus</i>)	
Buller's Shearwater (<i>P. bulleri</i>)	
Sooty Shearwater (<i>P. griseus</i>)	
Short-tailed Shearwater (<i>P. tenuirostris</i>)	
Black-vented Shearwater (<i>P. opisthomelas</i>)	
Fork-tailed Storm-Petrel (<i>Oceanodroma furcata</i>)	SSC
Leach's Storm-Petrel (<i>O. leucorhoa</i>)	
Ashy Storm-Petrel (<i>O. homochroa</i>)	FSC, SSC

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Table 7-9. The federal and state status of seabirds in California state waters.*	
Species	Status**
Black Storm-Petrel (<i>O. melania</i>)	SSC
Least Storm-Petrel (<i>O. microsoma</i>)	
California Brown Pelican (<i>Pelecanus occidentalis californicus</i>)	FE, SE, FPO
Brandt's Cormorant (<i>Phalacrocorax penicillatus</i>)	
Double-crested Cormorant (<i>P. auritus</i>)	SSC
Pelagic Cormorant (<i>P. pelagicus</i>)	
Black Scoter (<i>Melanitta nigra</i>)	
White-winged Scoter (<i>M. fusca</i>)	
Surf Scoter (<i>M. perspicillata</i>)	
Western Snowy Plover (<i>Charadrius alexandrinus nivosus</i>)	FT, SSC
Black Oystercatcher (<i>Haematopus bachmani</i>)	
Red Phalarope (<i>Phalaropus fulicaria</i>)	
Red-necked Phalarope (<i>P. lobatus</i>)	
South Polar Skua (<i>Stercorarius maccormicki</i>)	
Pomarine Jaeger (<i>S. pomarinus</i>)	
Parasitic Jaeger (<i>S. parasiticus</i>)	
Bonaparte's Gull (<i>Larus philadelphia</i>)	
Heermann's Gull (<i>L. heermanni</i>)	
Mew Gull (<i>L. canus</i>)	
Ring-billed Gull (<i>L. delawarensis</i>)	
California Gull (<i>L. californicus</i>)	SSC
Herring Gull (<i>L. argentatus</i>)	
Thayer's Gull (<i>L. thayeri</i>)	
Western Gull (<i>L. occidentalis</i>)	
Glaucous-winged Gull (<i>L. glaucescens</i>)	
Sabine's Gull (<i>Xema sabini</i>)	
Black-legged Kittiwake (<i>Rissa tridactyla</i>)	
Caspian Tern (<i>Sterna caspia</i>)	
Royal Tern (<i>S. maxima</i>)	
Elegant Tern (<i>S. elegans</i>)	FSC, SSC
Common Tern (<i>S. hirundo</i>)	
Arctic Tern (<i>S. paradisaea</i>)	
Forster's Tern (<i>S. forsteri</i>)	
California Least Tern (<i>S. antillarum browni</i>)	FE, SE, FPO
Black Tern (<i>Chlidonias niger</i>)	FSC, SSC
Black Skimmer (<i>Rynchops niger</i>)	SSC
Common Murre (<i>Uria aalge</i>)	RE
Pigeon Guillemot (<i>Cephus columba</i>)	
Marbled Murrelet (<i>Brachyramphus marmoratus</i>)	FT, SE
Xantus's Murrelet (<i>Synthliboramphus hypoleucus</i>)	FSC, SSC
Craveri's Murrelet (<i>S. craveri</i>)	
Ancient Murrelet (<i>S. antiquus</i>)	
Cassin's Auklet (<i>Ptychoramphus aleuticus</i>)	
Rhinoceros Auklet (<i>Cerorhinca monocerata</i>)	SSC
Tufted Puffin (<i>Fratercula cirrhata</i>)	SSC
Osprey (<i>Pandion haliaetus</i>)	SSC
Bald Eagle (<i>Haliaeetus leucocephalus</i>)	FT, SE, FPD

*Seabird species rare or vagrant to nearshore waters of California not included in this list.

**acronyms explained in Table 7-10.